GIANT ARCS – SPHERICAL SHELLS ?

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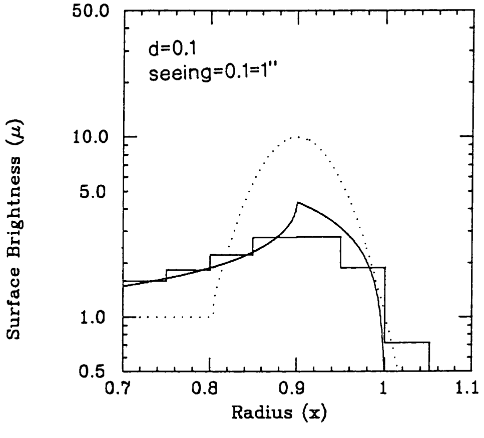
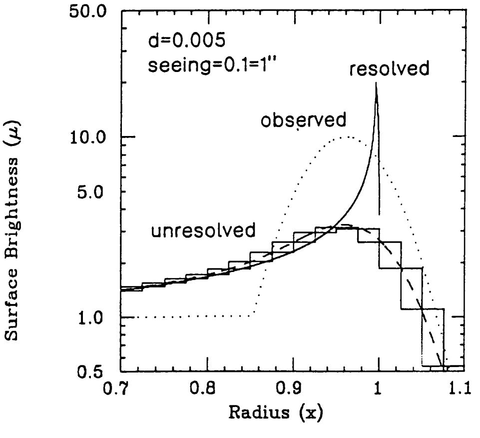
A noticeable fact about the giant luminous arcs, which have been detected in a few high-redshift clusters of galaxies (see contributions by Petrosian and by Mellier in this volume), is that they seem to be segments of almost perfectly *circular* rings – in one case spanning about one third of a circle. If this is a characteristic property of these arcs, they cannot be segments of randomly-oriented three-dimensional rings, which, when viewed from a random direction, should look acircular in most cases. Perhaps the most generic source for a circular ring is a limb-brightened luminous shell – as in planetary nebulae and supernova remnants. Such shells can naturally arise, for example, from explosion-generated shocks which cooled and fragmented into stars. If the sources are shells, and the arcs are either resolved or their thickness is determined by the seeing conditions (and by the CCD pixle size), there is a very general upper-limit on the possible surface-brightness *contrast* between the arcs and the regions encompassed by them. For the detected arcs, without any special fine-tuning, this limit is $\simeq 3$. It might become twice as big if the shell is transparent and the interior is opaque. This limit could exclude the shell model if the preliminary claims for a detected contrast greater than 10 are confirmed. It is interesting to note that the famous ring nebula presents a similar problem. We checked several mechanisms, such as stimulated radiation, which could, in principle, enhance the observed contrast while retaining the spherical symmetry; if such a mechanism is responsible for the enhanced contrast, it should show clear imprints on the spectrum. The figure shows the surface-brightess profile for a shell of thickness d.





J. Audouze et al. (eds.), Large Scale Structures of the Universe, 598.